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SUBSURFACE GEOMETRY AND STRUCTURE OF THE SAN ANDREAS AND ASSOCIATED FAULT ZONES FROM HIGH-RESOLUTION SEISMIC IMAGING

High-resolution (2.5 m CDP's) reflection/refraction images of the San Andreas (SAFZ) and other fault zones in California elucidate subsurface fault geometry and velocities from about 3 m to 5 km depth. Reflection images show that the SAFZ consists of numerous interconnected faults with varying components of slip. Near-surface faulting occurs over lateral distances of at least 1 km, but most faults merge with other faults in the upper few kilometers. Near Parkfield, the SAFZ is characterized by a 500-m-wide zone of faults at 3 km depth and a prominent low-velocity zone (LVZ = 2.9 km/s) that correlates with gravity, magnetic, and resistivity anomalies. We interpret the LVZ as an ~ 1.3-km-thick, fluid-bearing tectonic sliver of sedimentary rock resting adjacent to or is encompassing by the SAFZ. At Desert Hot Springs, the SAFZ is split into the Mission Creek (MCF) and Banning (BF) faults. The MCF is characterized by a 300-m-wide concentrated fault zone within a larger ~1-km-wide fault zone. The concentrated zone of faulting marks the transition from high-velocity (~5000m/s) crystalline rocks on the northeast side to a deep, low-velocity (< 2000 m/s), sediment-filled basin on the southwest side. The geometry of the MCF suggests that it joins the BF at depth to form a single SAFZ. Similar complexity is imaged in the Newport-Inglewood and Santa Monica fault zones. Large lateral and vertical velocity variations over short distances make shallow-depth fault-zone imaging difficult, but simultaneously acquired seismic reflection and refraction surveys utilizing densely spaced CDP's overcome most such difficulties.